Worthoceras pacificum Matsumoto & Yokoi, 1987 (Cephalopoda: Ammonoidea) from the Mzinene Formation (Cretaceous), Zululand

H.C. Klinger
South African Museum, Division of Earth Sciences, P.O. Box 61, Cape Town, 8000 Republic of South Africa

W.J. Kennedy
Geological Collections, University Museum, Parks Road, Oxford, OX1 3PW, United Kingdom

Accepted 2 July 1995

Three minute hetermorph ammonites of the genus Worthoceras were recovered from a core of a borehole in Zululand. This is the first record of the genus from South Africa. Their association with Neostlingoceras carctianense permits accurate dating with the eponymous zone of the Cenomanian stage.

Drie klein heteromorfe amoniete van die genus Worthoceras is gevind in 'n boorkern van Zoeloeland. Dit is die eerste melding van die genus van Suid-Afrika. Die voorkoms van dié amoniete met Neostlingoceras carctianense stel ons in staat om hulle akkuraat te dateer as behorende tot die gelyknamige sone van die Senomaan etage.

Introduction
A section of core from an exploration borehole in Zululand, ZOE.B (See Du Preez & Wolmarans, 1986, p. 13 for locality data) has yielded three specimens of the minute scaphitoid ammonite genus Worthoceras. This is the first record of the genus from Zululand.

Systematic palaeontology
Family Scaphitidae
Subfamily Otoscaphitinae
Genus Worthoceras

Type species
Macroscaphites platydorsus Scott, 1924 (1924: 18, plates 5 and 6, plate 9 (figure 6) by original designation of Adkins (1928, p. 218).

Diagnosis
Shell very small, coiling loosely scaphitoid. Spiral section evolute, ornament generally lacking on whole of shell. Suture simple with narrow saddles. L bifid or trifid. Phragmocone may extend onto part of shaft. Distinctly dimorphic, microconchs with more slender shafts and prominent lappets.

Discussion
Systematics within the genus Worthoceras are confusing, as is its correct familial position. The description of only three specimens from Zululand does not warrant a full discussion of these problems here, and only the salient aspects are pointed out.

With the exception of the distinctly ribbed species W. costatum (Henderson, 1973, p. 97, figures 11j, 12c, and 13, numbers 4a, 4b, and 5), most species referred to the genus Worthoceras lack any distinct ornament, and it is very difficult to distinguish the individual species satisfactorily. Cooper (1994, p. 172) regards W. costatum as an early representative of Otoscaphites because of the distinct ornamentation. In addition, Kennedy (1988, p. 113) has shown that the genus is distinctly dimorphic. Microconchs have slender body chamber shafts which do not conceal the umbilicus of the spire and an aperture with distinct lappets. Macroconchs are larger and have a stout body chamber that partially conceals the umbilicus and a simple aperture. According to Kennedy (1988, p. 113) W. vermiculus (Shumard, 1860, p. 419) and W. gibbosum (Moreman, 1942, p. 215, plates 34 (figures 7 and 8); text-figure 2q) are microconchs and macroconchs respectively; an opinion expressed previously by Förster et al. (1983, p. 130) on material from the Upper Cenomanian of Bavaria.

Adkins (1928, p. 218) admitted that he did not know where to place his new genus Worthoceras. Wright (1953, p. 474) placed the genus in a new subfamily, Otoscaphitinae of the Family Scaphitidae. These scaphitid affinities of Worthoceras were accepted by Henderson (1973), Vartak & Gharé (1987), and Kennedy (1988). In contrast, Wiedmann (1965, p. 441) preferred to place Worthoceras in the Ptychoceratinae. Unfortunately, his reasoning was flawed. He failed to recognize the effects of dimorphism on the presence or absence of lappets, as well as his alleged recognition of a phylogenetic recoil-trend in Worthoceras (Wiedmann, 1965, p. 442, text-figure 11). In addition, Wiedmann (1965, p. 439) placed too much emphasis on the trifid lateral (L) lobe of the Worthoceras he had examined. The specimens of Worthoceras from the Albian of New Zealand described by Henderson, W. parvum (Henderson, 1973, p. 96, figures 11f-i, 12a-b, and 13, numbers 7a, 7b, and 8); W. costatum and W. johnstoni (Henderson, 1973, p. 98, figures 11k and 13 number 9) have distinct bifid lateral lobes. This apparent instability of the lateral lobe was also commented on recently by Vartak & Gharé (1987, p. 300), Matsumoto (in Matsumoto & Yokoi, 1987, p. 45) compromised by referring Worthoceras to a new family, Worthoceratidae. Wright & Kennedy (in press) and Cooper (1994), however, prefer to retain Worthoceras in the Subfamily Otoscaphitinae as originally suggested by Wright (1953).

Occurrence
Despite its very small size, Worthoceras has been found in various parts of the world. The genus first occurs in the Upper Albian of Texas (Adkins, 1920; 1928; Scott, 1924; Clark, 1965), Upper Albian, Stoliczkaia dispar Zone of Hungary (Bujtor, 1991); possibly Upper Albian, Tunisia (Ferviniqué,
Figure 1 Worthoceras pacificum Matsumoto & Yokoi, 1987. A–B: BHB-3136, C: BHB-3101. Both from borehole BHB, Mzinene Formation, Lower Cenomanian, Zululand. A x 6; B,C x 4.

1910, p. 120, plate 4 (figures 28 and 29a–c); the uppermost Albian of New Zealand (Henderson, 1973), Upper Albian of Australia (Henderson, 1990), near the Albian/Cenomanian boundary of northeastern Mexico (Boe, 1923; Stinesbeck, 1991), Lower Cenomanian of Zululand (herein) and Madagascar (Collignon, 1929), Lower Cenomanian of Wiltshire, England (Kennedy, 1971), probable Cenomanian of Hokkaido (Matsumoto & Yokoi, 1987); possibly in the Middle Cenomanian of Algeria (as Scaphites tenuicostatus fide Cooper, 1994, p. 172); Middle Cenomanian of Mangystau, Transcaspia (Marcinowski, 1980, 1983), Middle Cenomanian of northwestern Germany (Riedel, 1943), Cenomanian of India (Vartak & Ghare, 1987), uppermost Cenomanian of Bavaria (Forster et al., 1983), Upper Cenomanian of France (Thomel, 1992); Upper Cenomanian of Texas, New Mexico, Colorado, Kansas, Wyoming (Kennedy, 1988); basal Turonian of Trans-Pecos, Texas (Kennedy et al., 1987), Lower and Middle Turonian of Texas (Clark, 1965, Kennedy, 1988), and

Upper Turonian of France (Roman & Mazerin, 1913) Turonian of Bohemia (Fritsch & Schloenbach, 1872).


Figures 1a–c, 2.

1929 Worthoceras rochatianus Collignon, non D'Orbigny (1850), p. 57, plate 7 (figures 8–10).

Material
BHB 310la, BHB 310lb, BHB 3136 associated with Neostingoceras carcitanense.

Description
All three specimens are microconchs with distinct lappets. The shell is small, maximum total length is 11 mm. The early spiral section is small, 3.9 mm in BHB-3101a and loosely coiled with an umbilical width of c. 49% of the diameter. This planispiral section is followed by a slender shaft with a distinct 'knick-point' at the point of uncoiling. The shaft is separate for at least half its length. Ornament on the hook appears to consist of very fine striae. The lappets are extremely delicate and more or less axe-shaped.

Discussion
Despite the differences in preservation, the three Zululand specimens of the authors are most similar to W. pacificum and that species is referred to. As Matsumoto & Yokoi (1987, p. 44) have also suggested, the specimens described by Collignon (1929, p. 57, plate 7 (figures 8–10) as Macroscaphites rochatianus from Diego Suarez do not belong to that Turonian species. Unfortunately, only the planispiral section of the Madagascan material is preserved, but that is indistinguishable from our specimens.

As mentioned above, it is difficult to distinguish between the various species of Worthoceras.
Unfortunately, the Mexican specimens figured by Stinnesbeck (1991) are poorly preserved, but his Worthoceras sp. C (Stinnesbeck, 1991, p. 68, plate 3 (figure 5a and b)) has an overall shell shape very similar to our material. Microconchs of W. vermiculus (Shumard, 1860) (see Kennedy, 1988, p. 114, plate 22 (figures 5, 10 – 15), plate 24 (figures 22 – 33), text-figure 39) lack the knick-point in the shaft of W. pacificum and the lappets appear smaller. Microconchs (i.e. W. gibbosum Moreman, 1942) have more inflated whorls and a much shorter shaft. Some of the Bavarian specimens figured by Förster et al. (1983, p. 129, plate 1 (figures 1 – 9)) as W. vermiculus approximate to our material in overall shape (e.g. Figure 8), but the planispiral section is larger. The Middle Cenomanian specimens from Mangyshlak figured by Marciniowski (1980, p. 248, plate 2 (figures 5 and 6) as W. vermiculus and W. rochattianum (Marciniowski, 1980, p. 247, plate 2 (figures 1 – 4, 7 – 9)) have flexuous shafts similar to W. pacificum, but the planispiral section appears smaller. As Kennedy (1988, p. 115) has pointed out, the Mangyshlak specimens belong to neither species, being intermediate in size between W. worthense and W. vermiculus. W. minor (Kennedy, 1988, p. 116, plate 21 (figures 1 – 10, 13 and 14, and 25) has a distinctly curved shaft in contrast to that of W. pacificum. W. platydorsatum (Scott, 1924) (see Adams, 1928, p. 219, plate 12 (figure 1)) has a smaller planispiral section and a larger shaft and hook, as do W. worthense (Adkins, 1920) (see Clark, 1965, p. 61, plate 23 (figures 1 – 3, 5 – 10); text-figure 22a). Microconchs of W. pygmaeum (Bujtor, 1991, p. 537, figure 2) also have stouter shafts. W. costatum (Henderson, 1973, p. 97, figure 11j, 12c, 13, numbers 4a and b, 5) has distinct ribbing as the name implies, and is easily identified. W. parvum (Henderson, 1973, p. 96, figure 11f – i, 12a and b, 13, nos 7a and b, 8) has a distinct collared aperture and small, linguiform lappets — it is obviously a microconch. W. johnstoni (Henderson, 1973, p. 98, figure 11k, 13 number 9) has a shorter, more inflated shaft, and is probably the microconch of W. parvum. W. rochattianum (D’Orbigny, 1850, p. 147) (Wiedmann, 1965, p. 439, plate 60 (figures 4 – 6); text-figure 10d) has a very small planispiral section and a longer, apparently more inflated shaft.

Occurrence

Two of the Zululand specimens, BHB 3101a and BHB 3101b occur associated with Neostingeloceras caritovianense which firmly dates them as early Cenomanian. The Japanese material occurs in washed-out calcareous nodules. The associated ammonites suggest an early Cenomanian age, but intermingling of nodules derived from the Albian could not be ruled out.

Acknowledgements

The Council for Geosciences, Pretoria, are thanked for access to the material. Financial assistance to Klinger by the FRD, South Africa is gratefully acknowledged. Thanks also to Samantha Black for the photography and drafting. Prof. R. Marcinowski and Dr. R.A. Henderson are thanked for critically reviewing the paper.

References


Editorial control: B. Rubidge.